RESEARCH AND DEVELOPMENT LABORATORY

January 1968

I. GENERAL

25X1

1. [redacted] combined development and production program is on schedule. This project has been assigned the highest priority in the Laboratory in order to bypass any possible bottle-neck in the heavily loaded engineering support, design drafting and mechanical fabrication sections. We cannot foresee any insurmountable technical problems nor serious vendor delay at this time.

2. We have received advance notice of upcoming projects for the fabrication of five or more secure voice links utilizing the KY-8 in conjunction with appropriate UHF or VHF equipment. These will also have to be undertaken on an assigned priority basis since we can accommodate only one or two such fabrication programs at one time.

3. A thin film capability was started in June 1967 to enable use of this type of miniaturized circuitry in future designs. This report gives the status of the thin-film project.

Several circuit designs have been made and tested with success. Initial problems with etching, flux, and epoxy have been solved leaving the substrate procurement problem, which may be solved by stockpiling. Overall yield depends on number of components per circuit but is estimated to be approximately 75% for 20% tolerance resistors, 50% for 10% tolerance resistors, and 10% for 5% tolerance resistors, assuming 10 resistors per circuit. These yields should improve as film uniformity improves. Only the substrate is lost in a reject circuit as LID devices and capacitors may be reused. A short description of the techniques and components follows:

Processing Steps

A. Substrate Procurement

25X1

Substrates have been ordered from two suppliers- [redacted] 25X1

[redacted]

problem has been the delivery of these substrates. No substrates to date have been received from Radiation Systems and slow delivery has been experienced with Electronic Film, Inc. Stockpiling substrates will solve this material problem.

B. Pattern Generation

Pattern generation procedures have been worked out which are completely satisfactory. Present needs do not require lines finer than 0.005". If finer lines are desired, the procedures would probably have to be tightened to obtain a good yield.

C. Resistor Trimming

Trimming of resistors is done on a hot plate at 1050°F. The circuit is allowed to remain at this temperature sufficiently long enough to convert the desired amount of chromium to chromium oxide. The circuit must be removed periodically and checked for resistor values. As more uniform film becomes available, better tolerances can be achieved. At present, 20% tolerances are routine, 10% tolerances have approximately 50% yield, 5% tolerances have approximately 10% yield.

D. Lead and Device Attachment

Alpha #830 flux with gold alloy solder, Alpha #235, produces a good bond; however, the flux attacked chromium and could not be removed easily. Initial failures of circuits during testing were believed due to the flux residue mixing with condensed water vapor which then dissolved the chromium film. This problem was eliminated by changing to a white gum rosin/alcohol flux, Alpha #100, which does not dissolve chromium and produces a good solder joint. Lid transistors and ceramic capacitors are appliqued using a heat column at 200°F. Flat nickel leads (pre-tinned with 60/40 solder) are soldered with a small iron at 515°F (circuit not on heat column).

E. Epoxy

To prevent possibility of leads lifting contact pads during normal handling, Hysol 11C epoxy is placed over the lead at the pad. In applying the epoxy, care must be taken to stay away from the resistors as chemicals in the epoxy change the value of the chrome resistors. Curing is done overnight at room temperature or in one hour at 150°F.

F. Testing

1. Circuit operation is tested at -20°C, +25°C (room temperature) and 60°C.

2. Circuit operation is tested at 95% humidity and 60°C.

3. Circuit operation is tested after being exposed to three cycles (15 minutes/cycle) in each plane of the following:

   a. 0.060" excursion 10 Hz - 55 Hz

   b. 10g acceleration 55 Hz - 500 Hz

G. Available Circuits

The following circuits have been made and can be obtained:

1. Crystal-controlled oscillator for 1 MHz - 24 MHz.

2. Tone oscillator.

3. Tone decoder.

4. Latching circuit.

H. Components

1. Resistors

Resistors have been made as low as 33 ohms and as high as 330 k. These limits may be stretched in future circuits. The power to be used in each resistor tailors the size of the resistor. In one circuit a 560-ohm 1/4 W resistor was needed and included. Full realization of volume reduction in microminiaturization prefers low power applications. Five, 10, 20% circuit tolerances can be made.

2. Capacitors

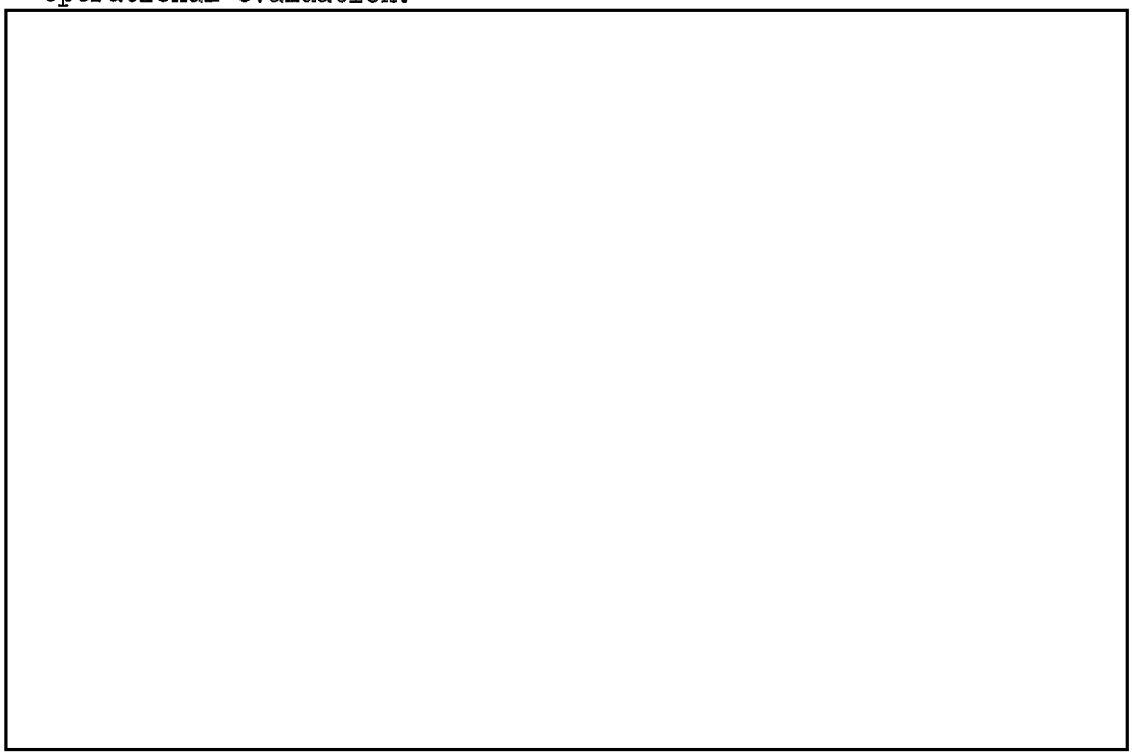
Ceramic capacitors which can be soldered directly to the substrate are available from Electro Materials Corp., and other manufacturers. Ten to 12,000 pF values are available in 0.050" x 0.095" packages. Other sizes are available but require more area for mounting.

3. Transistors, Diodes, Etc.

Amperex, Transitron, and KMC manufacture devices packaged in LID ceramic forms which can be soldered directly to the substrate. The wide variety of devices presently available include: general purpose transistors, switching transistors, high-frequency transistors, regular diodes, and zener diodes. In the near future, SCR devices and FET transistors will be available.

II. DESIGN

1. Several design projects are enjoying the limelight of successful operational evaluation. 25X1



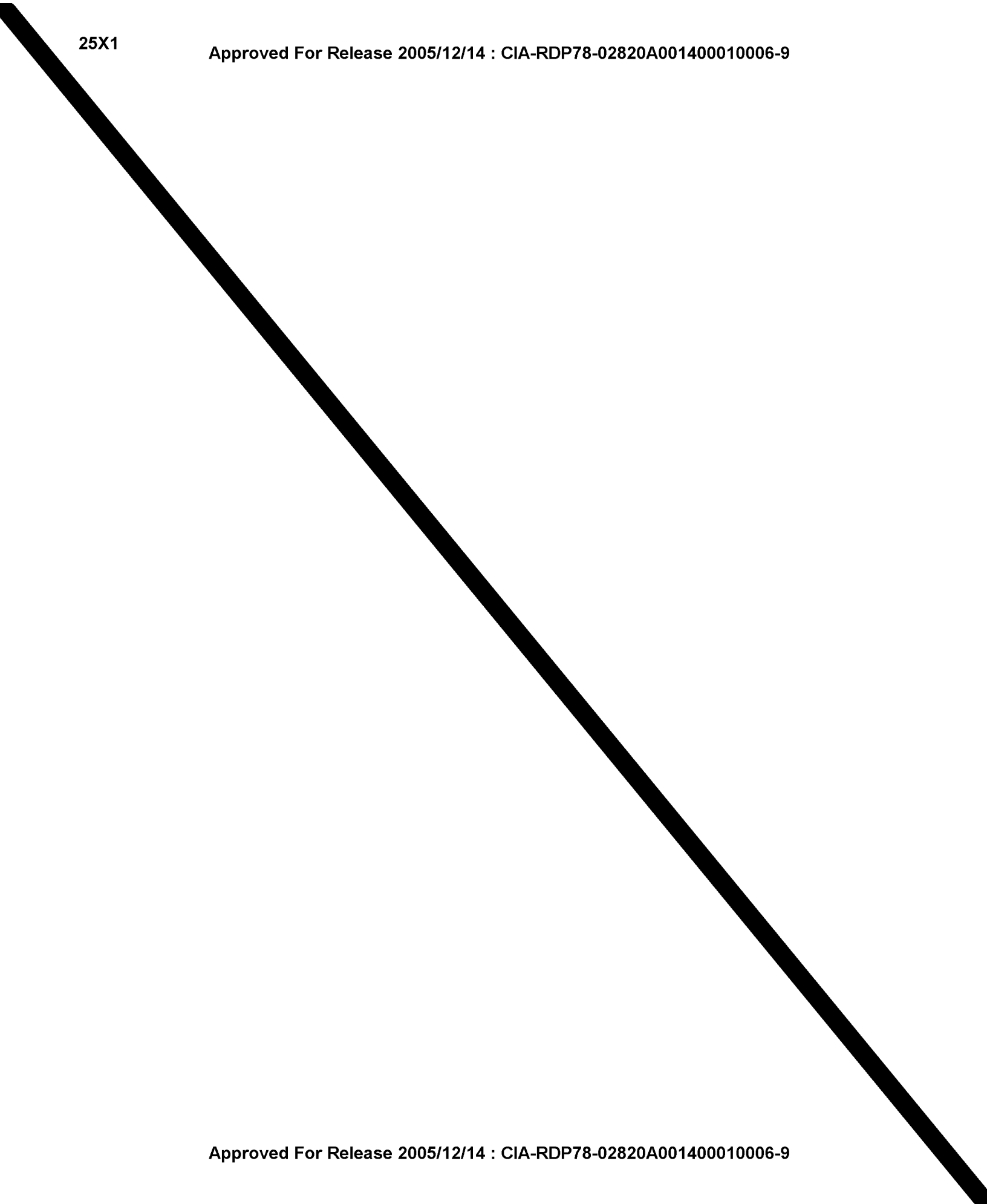
25X1

[redacted]

III. ANALYSIS AND APPRAISAL

1. Five evaluations were published and distributed during January. Eight others were completed and the reports written. Eight evaluations are in the testing phase. 25X1

IV. [redacted]



Approved For Release 2005/12/14 : CIA-RDP78-02820A001400010006-9